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# STRATEGIC DEFENSE SYSTEM: CRITERIA FOR DEPLOYMENT DECISION WILL NOT BE MET BY 1993; CRITICAL ISSUES MUST BE RESOLVED

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## FORTY-FIRST REPORT

BY THE

## COMMITTEE ON GOVERNMENT OPERATIONS

together with

ADDITIONAL AND DISSENTING VIEWS









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## LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
*Washington, DC, November 30, 1990.*

Hon. THOMAS S. FOLEY,
*Speaker of the House of Representatives,*
*Washington, DC.*

DEAR MR. SPEAKER: By direction of the Committee on Government Operations, I submit herewith the committee's forty-first report to the 101st Congress. The committee's report is based on a study made by its Legislation and National Security Subcommittee.

JOHN CONYERS, Jr., *Chairman.*

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## FIGURES



## ABBREVIATIONS

ABM—Antiballistic Missile
BMC3—Battle Management/Command, Control, and Communications
CRS—Congressional Research Service
DAB—Defensive Acquisition Board
GAO—General Accounting Office
GPALS—Global Protection Against Limited Strike
SDI—Strategic Defense Initiative
SDIO—Strategic Defense Initiative Organization

Union Calendar No. 587

101ST CONGRESS
*2d Session*

HOUSE OF REPRESENTATIVES

REPORT
101-994

# STRATEGIC DEFENSE SYSTEM: CRITERIA FOR DEPLOYMENT DECISION WILL NOT BE MET BY 1993; CRITICAL ISSUES MUST BE RESOLVED

NOVEMBER 30, 1990.—Ordered to be printed

Mr. CONYERS, from the Committee on Government Operations, submitted the following

## FORTY-FIRST REPORT

together with

## ADDITIONAL AND DISSENTING VIEWS

BASED ON A STUDY BY THE LEGISLATION AND NATIONAL SECURITY SUBCOMMITTEE

On October 23, 1990, the Committee on Government Operations approved and adopted a report entitled "Strategic Defense System: Criteria for Deployment Decision Will Not Be Met by 1993; Critical Issues Must Be Resolved." The chairman was directed to transmit a copy to the Speaker of the House.

### I. SUMMARY

Since 1984, the Congress has appropriated nearly $20 billion to support research and development of the Strategic Defense System. In the event of a massive ballistic missile attack by the Soviet Union, the Strategic Defense System is being designed to detect missile launches, discriminate warheads from hundreds of thousands of decoys, precisely track missiles and warheads, and then destroy them before they hit the United States. All this must occur within about 35 minutes or less and despite the enemy's concerted effort to defeat the system. The Strategic Defense System is, by far, the most complex, technologically challenging undertaking ever attempted. The system will consist of several subsystems (elements),

including surveillance satellites, space- and ground-based weapons, ground-based sensors and subsystems for command and control.

The Strategic Defense System is being developed in several phases. Phase I will be built using near-term technologies; later phases would use more exotic technologies such as neutral particle beams. The objective of Phase I is deterrence; Phase I will only destroy a certain classified percentage of missiles and warheads. It will take later phases of the system to provide a "total" defense. On September 17, 1987, the Secretary of Defense directed that Phase I enter the concept demonstration and validation stage of Defense's major acquisition process. This stage is important because enough information must be developed to show that the system is feasible before a decision is made to enter full-scale development. Because Phase I cannot be demonstrated outside of an actual ballistic missile attack, simulation and modeling of all the complex interactions becomes of paramount importance.

In 1988, the Strategic Defense Initiative Organization (SDIO) which manages the program, formally adopted an architecture for Phase I. Phase I was to be a highly integrated and interdependent system. SDIO cost estimates for Phase I have ranged from $183.6 billion (in then-year dollars adjusted for inflation) in June 1987 to the current estimate of $69 billion (in then-year dollars adjusted for inflation). In January 1990, SDIO significantly changed the Phase I architecture by incorporating a new space-based weapon called Brilliant Pebbles. The Brilliant Pebbles concept involves thousands of small, relatively autonomous weapons that could be deployed to detect, track, and intercept intercontinental ballistic missiles. However, because the 1972 Antiballistic Missile (ABM) Treaty prohibits the testing and deployment of space-based ABM systems, the deployment of Phase I with or without Brilliant Pebbles would violate the Treaty.

In 1986, the Congress enacted Public Law 95–145 which requires the President to certify that the Strategic Defense System can fulfill its mission and that the system is cost effective before any part of it can be deployed. The President is scheduled to make a decision by 1993 on deploying Phase I of the Strategic Defense System. SDIO is conducting its program to meet the 1993 date; however, SDIO will not be able to support an informed decision to deploy any single element, much less the total system. To do so requires a stable system objective and design, sufficient testing and evaluation, an accurate cost estimate and, according to SDIO, minimum funding levels. Additionally, the system must be cost effective, i.e., the cost of producing and deploying the system must be significantly less than it would cost an enemy to defeat it. However, it is highly improbable that SDIO can support any of these conditions; consequently, the criteria in Public Law 99–145 will not be met by 1993.

Several obstacles hinder SDIO from being able to support an informed decision to deploy Phase I by 1993. First, the system design of Phase I is still changing. Brilliant Pebbles significantly altered the design, changed the program, and SDIO's approach to strategic defense. SDIO has not solidified the role of Brilliant Pebbles or what elements will be in the final design. Furthermore, in response to congressional interest in a limited protection system, SDIO is

currently exploring yet another system design for possible early deployment. Consequently, a Phase I design will not be solidified until at least the spring of 1991.

Second, SDIO does not plan to conduct integrated system-level testing by the 1993 presidential decision date. Furthermore, because most of the system test and evaluation efforts have been based on the 1988 Phase I architecture, much of the test data and analyses may no longer be relevant and tests will have to be repeated. However, since the architecture will not be solidified until at least 1991, it will be extremely difficult—if not impossible—to design and run detailed system-level tests by 1993. Furthermore, because of treaty constraints, integrated testing of some of the elements is prohibited.

Third, according to SDIO, because of fiscal year 1990 funding cuts, research efforts have been scaled back, further reducing the amount of information that will be available for a presidential deployment decision.

Fourth, Phase I cost estimates are also still changing. Because of the fluid design, it is impossible to accurately estimate the cost of the system. Accurate cost estimates are critical to effectively weighing the cost of SDI against its likelihood for success and its potential benefit to the country.

Finally, high-level oversight by the Defense Acquisition Board (DAB) is not occurring. The 1989 DAB program review was not conducted. Even though a DAB review did occur in June 1990, a major change to the Phase I design, a significant reduction in test and evaluation requirements, and a decision to enter Brilliant Pebbles into an accelerated acquisition program had already been made.

Partly because of the recent work requested by this committee, the Congress has expressed real concern over the instability of the Phase I program. Because of these concerns, bills have been reported by both Houses imposing ceilings on expenditures for Phase I subsystems. Furthermore, both Houses recognize that the changing geopolitical situation has decreased the urgency of deploying a Phase I; consequently, both have recommended significant reductions in fiscal year 1991 funding for SDI.

The Committee on Government Operations wishes to acknowledge the work of Sally M. Obenski, detailed from the U.S. General Accounting Office, and Chris Aldridge, a former subcommittee staff member, for making important contributions to this report.

## II. Subcommittee Interest

On March 29, 1988, the Legislation and National Security Subcommittee conducted a hearing on the internal management control system in place at the Strategic Defense Initiative Organization (SDIO). In the course of that hearing, the subcommittee learned that the estimated costs necessary to make a decision on full-scale development (see appendix I) for the first part—or Phase I—of a Strategic Defense System had almost doubled from those originally indicated at the onset of the program.[1]

[1] Hearing on "Management of the Strategic Defense Initiative" before the Legislation and National Security Subcommittee, House Committee on Government Operations, 100th Congress, March 29, 1988.

Concern about the affordability of the Strategic Defense Initiative (SDI), especially in times of skyrocketing Federal budget deficits, a fading Soviet military threat, questions as to SDI's technical feasibility, arms control treaty compliance concerns, and other factors, prompted the chairman of the committee, Congressman John Conyers, Jr. (D-MI), to request a number of additional reports from the General Accounting Office concerning the way in which cost estimates for SDI were developed and how these cost estimates were presented to Congress.

In addition to the subcommittee's study and review of cost estimates for SDI, the overall capability of the Department of Defense to manage multibillion dollar weapons systems—critically dependent on computer hardware, software, and firmware [2] also became a matter of related investigation. Accordingly, the committee chairman requested that the General Accounting Office conduct a review of the computer resources management of the SDI program. This review developed into findings by GAO that SDIO will not be able to support currently scheduled full-scale development or deployment decisions on any part of Phase I of the Strategic Defense System.[3]

## III. Background

The Strategic Defense Initiative (SDI) is a program to research, develop, and deploy a Strategic Defense System. The primary goal is to defend the United States against a massive Soviet ballistic missile attack. Research and development for SDI began in 1984, and in 1987 a Strategic Defense System was approved for acquisition. This system is to be developed in multiple phases. Phase I is in the concept demonstration and validation stage of the Department of Defense's acquisition process.[4]

The cost for building the Strategic Defense System will be very high. Dollarwise, SDI is the largest peacetime military research program in history. The Strategic Defense Initiative Organization (SDIO) cost estimates for Phase I have ranged from a high of $183.6 billion (in then-year dollars) in June 1987 to the current figure of $69 billion (in then-year dollars).[5] Such significant changes in cost estimates for Phase I have concerned certain Members of the Congress.

In March 1989, the Legislation and National Security Subcommittee held a hearing to examine how the Strategic Defense Initiative Organization (SDIO) developed its 1988 cost estimate for Phase I and what the cost estimate meant in terms of actual appropriations. Chairman Conyers stated:

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[2] Hardware refers to physical equipment such as mechanical, magnetic, electric, and electronic devices; software refers to computer programs and supporting documentation; firmware refers to a combination of software and hardware used to control the operations of a particular computer.

[3] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO-IMTEC-90-61).

[4] The Department of Defense's major system acquisition process is supposed to provide a single approach to designing, developing, implementing, and maintaining major weapons systems. (The five stages of the acquisition process are discussed in appendix I.)

[5] Then-year dollars means adjusted for inflation.

> Cost estimates are an important part of the current debate over the validity of the Strategic Defense Initiative. In this era of increasing budget deficits, the cost of this program must be carefully weighed against its likelihood for success and its potential benefit to the country.[6]

### A. CHRONOLOGY OF SDI PROGRAM

On March 23, 1983, President Reagan announced to the Nation that the United States would undertake a program of intense research into technologies which would provide a "thoroughly reliable" defense against nuclear ballistic missiles. In January 1984, SDI was established as a research and technology development program. The Strategic Defense Initiative Organization (SDIO) was created by a directive of the Secretary of Defense on April 24, 1984, to manage the SDI program.

After several years of research, SDIO decided in 1987 to develop and deploy the system in phases. SDIO felt that working in phases would allow them to be prepared for an early deployment, if such a decision were made, and to respond to changing threats. The first phase is not intended to be a "total defense," but is being designed to destroy only a certain classified percentage of intercontinental and sea-launched ballistic missiles and deployed warheads. Creating a full strategic defense capability will require the deployment of follow-on phases not to mention thoroughly reliable defenses against strategic aircraft and cruise missiles. According to the Director of SDIO, at the 1989 hearing, the infrastructure for follow-on phases will be built during the first phase of the program. Phase I will consist of sensors and a battle management command, control, and communications (BMC3) system which form this infrastructure. In addition to the sensors and BMC3, Phase I will have space- and ground-based interceptors.[7] Phase I is to be based on near-term technologies, while later phases are to incorporate more exotic technologies.

A recent GAO report to the subcommittee stated:

> From the beginning, SDIO had one overall goal—to conduct a vigorous research and technology program that would provide the basis for an informed decision regarding the deployment of the Strategic Defense System. The current Phase I program is intended to support an executive decision on deployment by the President in 1993 and an acquisition decision on full-scale development by Defense in 1994 or 1995. According to SDIO officials, the President will have a range of options including deploying, delaying, or cancelling Phase I. However, if the President decides to deploy the system, Phase I development will not be consistent with Defense's prudent acquisition policies specify-

[6] Hearing on "Cost Estimates for Phase I of the Strategic Defense Initiative" before the Legislation and National Security Subcommittee, House Committee on Government Operations, 101st Congress, March 21, 1989.

[7] Ibid.

ing that deployment decisions be made after full-scale development.[8]

### B. OBJECTIVE OF THE STRATEGIC DEFENSE SYSTEM

At its inception, the overall program goal was to render ballistic missiles impotent and obsolete. The goal, or objective of Phase I became deterrence, i.e., to provide such a formidable defense and uncertainty as to success that the enemy would not launch a massive ballistic missile attack. If such a launch occurred, however, Phase I is intended to intercept intercontinental ballistic or sea-launched missiles or deployed warheads as they travel toward the United States. The system is based on a layered defense concept; separate sensor, weapon, and command and control systems—called elements—would be in space and on the ground. The system would be tied together by a complex and highly sophisticated battle management, command, control, and communications (BMC3) system. During an attack, the system would have to function in an extremely hostile, nuclear environment and would have to thwart a concerted effort by the enemy to counter and destroy the Strategic Defense System.

The threat the system would be facing and the environment in which the system must operate create the need for development of the most technically complex initiative ever attempted. The GAO report stated:

> First, the space-based elements of the system have to be able to detect and begin tracking thousands of missiles almost immediately after launch, and then intercept and destroy some of them. Those missiles that are not destroyed would release warheads mixed with decoys to confuse the system forcing the system to track hundreds of thousands of objects. In addition to tracking the hundreds of thousands of objects as they travel toward the United States, the system would have to discriminate among warheads and decoys to provide weapon target assignment information for destruction of some of the warheads. These functions would have to be tightly coordinated and performed in less than 35 minutes—all this with nuclear warheads exploding, anti-satellite weapons attacking the system, and the enemy trying to disrupt communications and computer operations.[9]

Figure 1 describes the phases of a ballistic missile attack.

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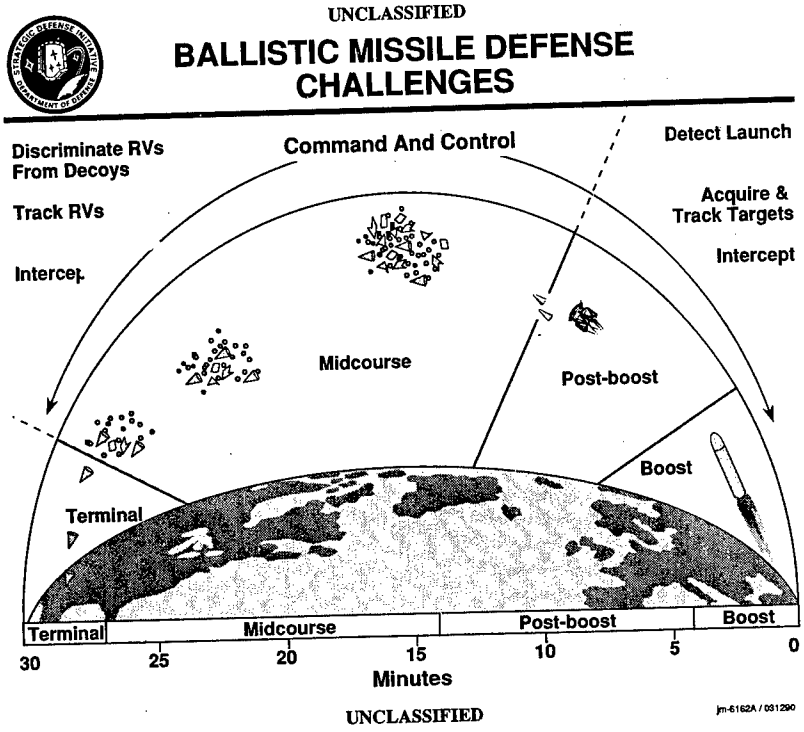
[8] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[9] Ibid.

Figure 1: Phases of a Ballistic Missile Attack




(Source: SDIO Briefing to the Defense Acquisition Board, 6/15/90.)

## C. OBJECTIVE AND DESCRIPTION OF PHASE I

SDIO's policy has been to maintain a balance between the acquisition of Phase I and the research and development of technologies for follow-on phases. As mentioned above, according to the Director of SDIO, Phase I is to provide the infrastructure upon which future phases can build. SDIO's proposed Strategic Defense System can be divided into three major parts: a sensor suite to detect ballistic missiles and their warheads; a battle management, command, control, and communications (BMC3) system; and space- and ground-based weapons. The first two, the sensor suite and the BMC3 element form the system infrastructure and are to be built during Phase I. Space- and ground-based kinetic energy weapons would also be developed and deployed as part of the Phase I system. Later phases using directed energy weapons such as lasers and neutral particle beams would be added to the basic infrastructure already in

place.[10] As mentioned earlier, Phase I is not meant to provide for a "total defense." Additionally, as a contingency, SDIO has stated that Phase I could provide protection from an accidental launch or a limited attack from a third world nation.

The GAO reported that:

> In 1988, a Phase I design, made up of seven elements, was approved by the Defense Acquisition Board. The design consisted of two space-based sensors (Boost Surveillance and Tracking System and Space Surveillance and Tracking System); a space-based weapon (Space-Based Interceptor); two ground- based sensors (Ground Surveillance and Tracking System and Ground-Based Radar); and a ground-based weapon (Ground-Based Interceptor), all managed by a command and control system (Command Center Element). The six surveillance and weapon elements would be highly interdependent and rely heavily on the command and control element, along with a complex communications system. The individual elements would work together as an integrated system to detect, track, discriminate, and destroy ballistic missiles and their warheads. At the heart of the system is a large, distributed, real-time computer system which, by some estimates could have 40-100 million lines of code.[11]

For a description of the 1988 Phase I elements, see appendix II.

In January 1990, SDIO decided to include a new weapon concept, called Brilliant Pebbles, in Phase I. As originally envisioned, Brilliant Pebbles involves several thousand individual interceptors orbiting the earth in order to detect and destroy a target by smashing into it at high speed. Brilliant Pebbles is intended to improve system survivability and reduce costs by dispersing thousands of space-based interceptors that are smaller and more autonomous than the Space-Based Interceptor. The Space-Based Interceptor would house a number of interceptors, but unlike Brilliant Pebbles, it would rely on other satellites for tracking, targeting, and communications. By making interceptors autonomous, they would no longer need to rely on other satellites to perform these functions. Further, because each interceptor would work independently, the system's survivability would increase, in principle, because the loss of any one interceptor would not greatly affect the system's overall effectiveness.[12] Figure 2 shows Phase I with the six elements and Brilliant Pebbles.

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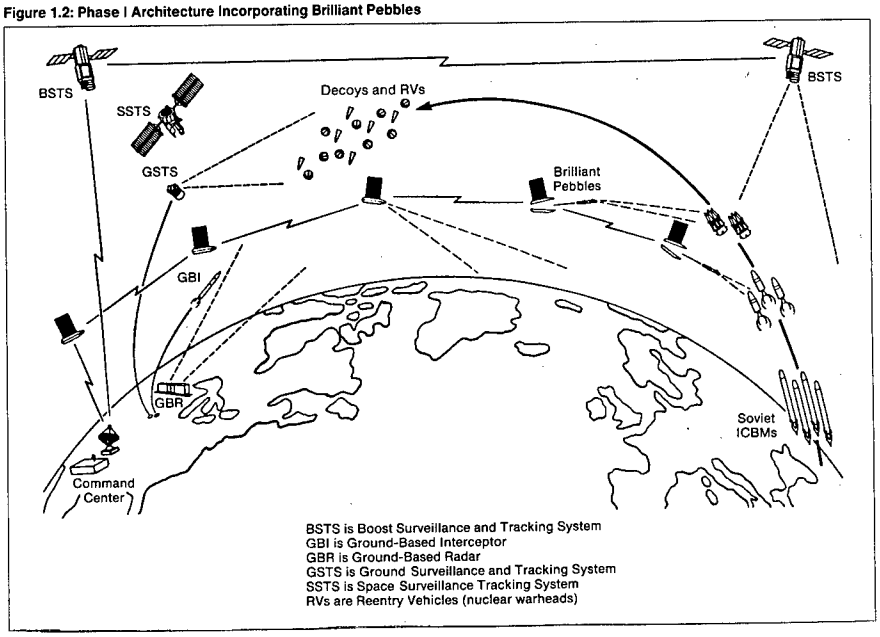
[10] Hearing on "Cost Estimates for Phase I of the Strategic Defense Initiative" before the Legislation and National Security Subcommittee, House Committee on Government Operations, 101st Congress, March 21, 1989.

[11] Report to the chairman Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[12] Ibid.

Figure 1.2: Phase I Architecture Incorporating Brilliant Pebbles




SDIO funded several Brilliant Pebbles research and development studies during 1989 and 1990. The space-based architecture study examined the space-based components and recommended an architecture to SDIO. Studies completed by the Defense Science Board and the JASONS—a group of scientists who periodically provide technical support to Defense—determined that the Brilliant Pebbles concept was technically feasible. However, neither the space-based architecture study or the Defense Science Board study recommended incorporating Brilliant Pebbles into the Phase I architecture.

### D. CHRONOLOGY OF COST ESTIMATES FOR PHASE I

Another GAO report on Phase I provided the following background information:

> In June 1987, SDIO estimated that the Phase I Strategic Defense System would cost between $75 billion and $145.7 billion in fiscal year 1988 dollars (between $94.2 billion and $183.6 billion in then-year dollars). SDIO did not make a more precise estimation because details about the technical characteristics and performance requirements for a Strategic Defense System were not well defined or decided.
>
> In June 1988, SDIO revised the architecture and the technical and performance characteristics of the elements in the Phase I system and estimated the cost to be $115 billion in fiscal year 1988 dollars ($142.9 billion in then-year dollars). The Department of Defense's Cost Analysis Improvement Group reviewed SDIO's estimate and deter-

mined that the program, as proposed, was not executable within fiscal guidelines.

By October 1988, SDIO had restructured the program and reduced the estimate to $69.1 billion in fiscal year 1988 dollars ($88.9 billion in then-year dollars). [13]

By incorporating Brilliant Pebbles and eliminating the Space-Based Interceptor from Phase I, SDIO claims that Phase I costs will be cut by 20 percent, that is from $69 billion to about $55 billion ($88.9 billion to about $69.6 billion in then-year dollars).

The GAO report further stated:

> These estimates include funding to develop, produce, and deploy Phase I. They do not include funding for any follow-on technologies or costs to operate and support the system once deployed.[14]

### E. IMPORTANCE OF TEST AND EVALUATION AND DEFENSE OVERSIGHT

On September 17, 1987, the Secretary of Defense directed that Phase I of the Strategic Defense System be moved out of research and development and into the concept demonstration and validation stage of Defense's major system acquisition process. (See appendix I.) After successfully completing concept demonstration and validation, Phase I could enter full-scale development. The Secretary of Defense's decision to place a major system in full-scale development is extremely important. During full-scale development, the system is built, tested, and ready for full-rate production. Not only will development consume enormous resources, but major systems, at this point, frequently take on a life of their own and are seldom canceled.

Each stage of the acquisition process, as well as each milestone decision, is to be supported by test and evaluation. The purpose of test and evaluation is to help ensure the timely development, production, and fielding of systems that meet users' requirements and perform as intended. To help Defense gain sufficient design and development information, major system acquisitions are reviewed by the Defense Acquisition Board (DAB), which is chaired by the Under Secretary of Defense for Acquisition. The purpose of the DAB is to oversee major Defense acquisitions. The DAB reviews each acquisition stage to ensure that every program is ready to proceed into more advanced stages of development or production. The DAB relies on information from test and evaluation to make such determinations.

The complexity, cost, and uniqueness of the Strategic Defense System have prompted the need for a more detailed program review process. Although formal DAB reviews are usually required at major milestones, the SDI program is also supposed to have yearly progress reviews before the DAB. Further, SDIO must peri-

[13] Fact sheet for the chairman, Legislation and National Security Subcommittee, Committee on Government Operations, House of Representatives, "Strategic Defense Initiative: Funding Needs Through Completion of Phase I System" (GAO/NSIAD-90-79FS).

[14] Ibid.

odically submit additional documentation to the DAB to ensure program goals are being met.[15]

### F. ROLE OF SIMULATION IN TESTING

The July GAO report found that:

> Because the Strategic Defense System cannot be tested in its operational environment, many system capabilities must be demonstrated through computer modeling and simulation. For example, in simulations, software models would mimic the behavior of sensors and weapons and be used in place of the actual elements to evaluate system performance. A ballistic missile attack from launch to impact must also be simulated in software to prompt the element models to respond. Eventually, some of these tests would involve actual prototypes of weapons and sensor hardware, software, and a human interacting in the simulation. This type of integrated system-level testing would be used to evaluate the performance of elements within the context of the entire Strategic Defense System. Thus the ability to simulate the interaction of the system's thousands of computers with their many millions of lines of software code becomes of paramount importance in demonstrating whether the system can perform its mission.[16]

### G. ABM TREATY

The 1972 Antiballistic Missile (ABM) Treaty regulates the development, testing, and deployment of ABM systems whose components were defined in 1972 as consisting of ABM interceptor missiles, ABM launchers, and ABM radars. ABM systems based on other physical principles are also addressed and include components that could substitute for ABM interceptor missiles, ABM launchers, or ABM radars.

According to a Congressional Research Service issue brief:

> The ABM Treaty embodies a belief that the relationship between offensive nuclear weapons and strategic ballistic missile defense is highly complex and that when deployed together they can lead to strategic instability. The ABM Treaty purposefully restricted ballistic missile defense deployment to a number of fixed, land-based ABM systems and components.[17]

Under the traditional or narrow interpretation of the treaty, adopted by both the administration and the Congress, research is permitted, but the development, testing, and deployment of air-, sea-, space-, and mobile land-based ABM launchers, interceptors, and radars are restricted. According to SDIO's 1989 report to the Congress on SDI compliance with the treaty, research includes con-

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[15] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[16] Ibid.

[17] Congressional Research Service Issue Brief, "The Strategic Defense Initiative: Issues for Congress," updated April 18, 1989.

ceptual design and laboratory testing. Development occurs after research but precedes full-scale testing.[18]

The ABM Treaty permits a limited deployment of fixed ground-based ABM components and allows the testing of such components in two predefined sites—Kwajelein and White Sands Missile Range. Field testing not conducted at Kwajelein or White Sands can only include components that are not ABM capable.

The Department of Defense has in place a compliance process under which the Under Secretary of Defense for Acquisition, in consultation with the Department's General Counsel, Under Secretary of Defense for Policy, and Chairman of the Joint Chiefs of Staff, ensures that all defense programs are in compliance with all United States strategic arms control obligations. SDI experiments, tests, and other research and development efforts prior to execution will be carefully screened by the Department's compliance review group to certify that planned activities fully comply with the ABM Treaty. Additionally, the Director of SDIO is required to certify continued compliance quarterly.[19]

## IV. Decision on Phase I Deployment Scheduled for Early 1993

The President is scheduled to make a decision by 1993 on deploying Phase I of the Strategic Defense System. SDIO is conducting the SDI program to support a decision by the President prior to the completion of his current term. In the fiscal year 1986 defense authorization bill, the Congress adopted legislation establishing criteria for making future decisions on whether to deploy advanced ballistic missile defenses (Public Law 99–145, section 222). The criteria are similar to those proposed by Ambassador Paul H. Nitze, Special Advisor to the President on arms control matters, in an address in Philadelphia on February 20, 1985. The legislation states that:

> A strategic defense system developed as a consequence of Research, Development, Testing and Evaluation conducted on the SDI program may not be deployed in whole or in part unless:
>
> (1) the President determines and certifies to Congress in writing that:
>
> (a) the system is survivable (i.e., the system is able to maintain a sufficient degree of effectiveness to fulfill its mission, even in the face of determined attacks against it); and
>
> (b) the system is cost effective at the margin to the extent that the system is able to maintain its effectiveness against the offense at less cost than it would take to develop offensive countermeasures and proliferate the ballistic missiles necessary to overcome it; and
>
> (2) funding for the deployment of such system has been specifically authorized by legislation enacted

[18] 1989 Report to the Congress on the Strategic Defense Initiative, March 13, 1989, appendix C.

[19] Statement on the Strategic Defense Initiative by Lt. Gen. George L. Monahan, Jr., Director, SDIO, before the Subcommittee on Defense, Committee on Appropriations, House of Representatives, April 26, 1990.

after the date on which the President makes the certification to Congress.[20]

To support the criteria in Public Law 99-145 requires a stable system design, adequate testing and evaluation, minimum funding levels, an accurate cost estimate, and evidence that the system is cost effective. It is highly improbable that SDIO will be able to support any of these conditions by 1993.

## V. Phase I Architecture Continues To Change

In its July 1990 report GAO stated that:

> In January 1990, Brilliant Pebbles was formally incorporated into the Phase I design. However, exactly what role Brilliant Pebbles will play in the Phase I architecture and even what pieces of Phase I will be deployed is uncertain and consequently has put the design of the Strategic Defense System into a state of flux. The result is a destabilized architecture and a major restructuring of SDIO's program.[21]

### A. SDIO STUDIES ON BRILLIANT PEBBLES DO NOT RECOMMEND INCORPORATION INTO PHASE I ARCHITECTURE

Two major studies performed by the Defense Science Board and by SDIO respectively did not recommend incorporating Brilliant Pebbles into the architecture. Each stated additional research was needed and that research should continue on both the Space-Based Interceptor and on Brilliant Pebbles. The Defense Science Board suggested that this arrangement continue until the advantages and disadvantages of a system architecture based on Brilliant Pebbles are clearly understood in a quantifiable manner.[22] It stated:

> Although the SDI is supposed to be a research and development program, the "build" model has been applied and has led to fixing the system design too early, before adequate exploration of alternative technologies was completed.[23]

In addition to the Defense Science Board study, Defense issued a space-based architecture study which reviewed the four space-based elements of Phase I—Boost Surveillance and Tracking System, Space Surveillance and Tracking System, the Space-Based Interceptor and Brilliant Pebbles—and defined and justified a recommended space-based architecture. The space-based architecture study also recommended that:

> Research continue on both Brilliant Pebbles and the Space-Based Interceptor and that modified versions of the

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[20] Congressional Research Service Issue Brief, "Strategic Defense Initiative (SDI): Mission Objectives for Directing the Program," updated May 3, 1989.

[21] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[22] "SDIO Brilliant Pebbles Space Based Interceptor Concept," December 1989, prepared by the Defense Science Board.

[23] Ibid.

Boost Surveillance and Tracking System and the Space Surveillance and Tracking System sensors be included.[24]

### B. ALTHOUGH ROLE NOT DEFINED, BRILLIANT PEBBLES NOW "CORNERSTONE" OF PHASE I

According to SDIO officials and the GAO report, Brilliant Pebbles has for the moment, become the focal point or so-called "cornerstone" of the Phase I architecture. With Brilliant Pebbles, the system would no longer be dependent on two distinct space-based surveillance satellite constellations to provide booster tracking and targeting information. Brilliant Pebbles would perform many of these functions, significantly changing SDIO's Phase I architecture and approach to strategic defense. The pre-Brilliant Pebbles architecture was made up of seven highly integrated elements; command and control relied on rapid communication and data sharing among elements. With the addition of Brilliant Pebbles and its 4,000-plus space-based platforms, survivability of the system would be increased by getting away from such an interdependent architecture. However, in order to command and control each of the weapons individually, the complexity of the BMC3 system could be dramatically increased.[25]

According to a September 1989 CRS report, SDIO explored several options for a Brilliant Pebbles-based strategic defense. The "baseline" Brilliant Pebbles concept [26] envisaged meeting Phase I mission requirements entirely with a lean, space-based system. This option included the thousands of self-contained interceptors, a ground-based command center, and a Boost Surveillance and Tracking System for independent early warning, attack characterization, and communication. This option would not mount a coordinated defense; each Pebble would act autonomously and possess only enough data processing capacity to choose its own target. The report went on to say that SDIO has assessed another option in which Brilliant Pebbles would launch a coordinated attack by being commanded and controlled from a ground- or space-based battle manager. In both cases, the battle would occur during the boost and post-boost phases prior to the release of warheads. SDIO also studied the cost effectiveness of retaining the Space Surveillance and Tracking System to target warheads after they are released from the boosters. This would expand Brilliant Pebbles' role to the midcourse battle. Another option was to keep all of the 1988 Phase I elements, but substitute Brilliant Pebbles for the Space-Based Interceptor.[27]

As mentioned earlier, the Space-Based Architecture Study and the Defense Science Board study examined the excursions mentioned above. Neither study recommended that Brilliant Pebbles be incorporated into the architecture but that research continue on

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[24] "Space-Based Architecture Study," October 25, 1989.

[25] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[26] The so-called "baseline" concept is the original concept developed and promoted by scientists at Lawrence Livermore National Laboratory.

[27] Congressional Research Service's report for Congress, "Brilliant Pebbles: Implications for the Strategic Defense Initiative," September 28, 1989.

both the Space-Based Interceptor and Brilliant Pebbles. Nevertheless, Brilliant Pebbles was incorporated into the design and in spring 1990, multiple contracts were let for an 8-month concept definition phase for Brilliant Pebbles' development. According to the statement of work in the request for proposals, the technical goals of the concept definition study are twofold:

> (1) Evaluating the Lawrence Livermore National Laboratory Brilliant Pebbles concept and exploring/incorporating modifications, where needed.
>
> (2) Defining, analyzing, and justifying a Brilliant Pebbles development program which could lead to a cost effective, timely development and deployment of the Brilliant Pebbles system.[28]

SDIO plans to follow this procurement with a competition for a pre-full-scale development phase. The competition will be limited to those contractors selected to participate in the concept definition phase.

### C. PHASE I ARCHITECTURE REMAINS UNCERTAIN

The Phase I architecture is still changing and hence remains in a state of flux. For example, with Brilliant Pebbles as a replacement for the Space-Based Interceptor, the Boost Surveillance and Tracking System may not be required as a Phase I element. Brilliant Pebbles could reduce tracking requirements placed on the Space-Surveillance and Tracking System, and could expand the mission of the Ground Surveillance and Tracking System. Because Brilliant Pebbles provides for several thousand self-contained interceptors that could detect and destroy missiles independently of the other Phase I elements, interfaces, sensing and tracking capabilities, communications, and the numbers of elements needed—both in terms of types and constellations—would have to be reassessed.[29]

Defense officials have stated that the Phase I architecture will not be solidified until 1991. Per Presidential guidance, Brilliant Pebbles is in an accelerated acquisition program.

Meanwhile, SDIO is undertaking another program restructuring. The new SDIO Director has stated that there will likely be a change in focus of near term deployment efforts to a Global Protection Against Limited Strike (GPALS) system. The Director went on to say that GPALS has gained interest because of the third world ballistic missile threat. According to the Director, GPALS would shift the near-term deployment objective to protection, not deterrence. As a result, SDIO will probably be migrating to different system objectives in the near future. According to the Director, the GPALS will not take the place of the current Phase I but could grow to a Phase I Strategic Defense System.

We agree with the concerns raised in the GAO report that unless the architecture is stabilized and the respective elements are devel-

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[28] Memorandum for Prospective Offerors: "Solicitation for Concept Definition Phase of the Brilliant Pebbles System, RFP No. SDIO84-90-R-0004," February 27, 1990.

[29] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

oped, designed, and tested as an integrated system, SDIO will not know whether the system will work as planned.[30]

## VI. Sufficient Testing Will Not Occur Prior to Presidential Deployment Decision

The incorporation of Brilliant Pebbles into the architecture has prompted a major restructuring of the Phase I design. According to the GAO report, SDIO officials are rewriting test plans to reflect this major change in the design. Additionally, the GAO study found:

> SDIO-funded studies and test plans cite the importance of conducting integrated system-level tests in real time, using actual system hardware and software with human intervention.[31] However, an integrated system-level test in real time using hardware and software and a human-in-the-loop will not be demonstrated prior to the planned 1993 decision on deployment. SDIO officials feel they will be able to support a presidential deployment decision with less information than was originally desired, but state that this will be done at increased risk.[32]

### A. PRE-BRILLIANT PEBBLES TESTS AND EVALUATIONS MAY NO LONGER BE VALID

The July 1990 GAO study reported that:

> Because most of the test and evaluation efforts have been based on the 1988 Phase I architecture, much of the test data and analysis performed may no longer be relevant. For example, if the Boost Surveillance and Tracking System is no longer in the architecture and the Space Surveillance and Tracking System will no longer provide tracking information, then all of the modeling and simulation done so far is useless because all the interfaces and data paths have changed. Any change to one element causes this rippling effect across the system.
>
> Further, system-level tests and resulting requirements have not included Brilliant Pebbles. Accordingly, system tests must be rewritten and actual simulations rerun to include them. Because the other Phase I elements have not included Brilliant Pebbles in their tests, analyses, and development, element test plans must also be reassessed.[33]

However, since the architecture will not be solidified until 1991, it will be extremely difficult to design and run detailed system-level tests by 1993.

### B. SDIO HAS REDUCED ITS TEST AND EVALUATION REQUIREMENTS

The GAO study disclosed that even before Brilliant Pebbles, SDIO had significantly reduced its integrated system-level test re-

[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Ibid.

quirements. This is very disturbing since SDIO-funded studies and test plans supported integrated system-level tests in real time using actual system hardware and software prototypes with human intervention to support development and deployment decisions. The study stated that the value of integrated system-level testing cannot be overstated. It is this level of testing that will help confirm whether the individual elements and the strategic defense commander can successfully interact in real time. Actual hardware and software in the test environment will provide significantly more information about system performance than a model. While GAO reported that SDIO does plan to perform integrated system-level testing, it will not be conducted prior to the President's scheduled 1993 decision.[34]

### C. ABM TREATY CONSTRAINS LEVEL OF TESTING

The proposed Phase I system currently under development cannot be deployed under the terms of the Antiballistic Missile (ABM) Treaty. As mentioned earlier, the ABM Treaty regulates the development, testing, and deployment of ABM systems whose components were defined in the 1972 treaty as consisting of ABM interceptor missiles, ABM launchers, and ABM radars. Under the narrow interpretation, the development and testing of mobile-based (to include space-based) ABM systems are prohibited. According to SDIO, most of the major SDI experiments are field tests of devices that are not ABM components or prototypes of ABM components. Test data will be combined with data from other experiments and computer simulation in order to make a feasibility decision.[35]

The deployment of the mobile ground-based radar would violate the treaty. Furthermore, under the narrow interpretation, the development and testing of such a mobile radar is prohibited. However, many field tests may include a stationary version of the radar, but it cannot be ABM capable or be tested outside the two defined ABM test sites. Even field tests at Kwajelein or White Sands must be conducted on a stationary radar. As mentioned above, the mobile characteristics must be incorporated through computer simulations.

Deployment and integrated testing of all Brilliant Pebbles components in its operational environment would be in violation of the treaty. SDIO has offered alternatives to a fully integrated test on Brilliant Pebbles, but Defense's compliance review group has not, to date, determined which alternative, if any, would be acceptable.

The above two examples illustrate SDIO's catch-22 situation. SDIO will not be able to conduct the kind of testing needed to demonstrate the feasibility of the elements without abrogating the treaty. However, it makes little sense to abrogate the treaty before the feasibility of the system has been demonstrated.

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[34] Ibid.

[35] "Must the United States Abrogate the ABM Treaty to Test SDI," statement of Director SDIO, provided to the GAO by the General Counsel, SDIO, Treaty Compliance.

## VII. SDIO Asserts Minimum Funding Levels Needed To Support 1993 Decision

The GAO reported:

> An informed executive decision on deployment is contingent, in part, on minimum funding levels; at one time, this decision was to occur in the same time-frame as Defense's formal, full-scale development decision. In most major acquisitions, a deployment decision is made after full-scale development is complete and the system has moved into the next stage. (See appendix I.) According to SDIO's Director, an informed decision on deployment is contingent on funding levels of $4.6 billion for fiscal year 1990 and $33 billion over fiscal years 1989-1994. He stated that any funding reduction would reduce the confidence of the deployment decision and would have increasingly serious consequences for the SDI program. For example, the Director stated that a 20 percent funding cut would reduce the confidence in making a decision on deployment due to cutbacks in research. He further stated that emerging concepts, especially Brilliant Pebbles, would not be fully explored. Hence, the space-based architecture would not be completely defined, and initial system development and deployment schedules would be delayed at least 2 years.[36]

If the program were funded at 70 percent of the requested level, the Director of SDIO stated that the research and testing needed to make an informed deployment decision by 1993 could not be supported and that an initial deployment would be delayed until well after the year 2000 with no provision for follow-on systems.[37]

The Congress reduced SDIO's fiscal year 1990 budget request by 20 percent (from $4.6 billion to $3.6 billion) because of congressional concern for overall fiscal constraints and SDIO's current major uncertainties for fiscal year 1990. Consequently, SDIO initiated a major replanning and restructuring strategy to identify program priorities and impacts, and SDIO delayed its full-scale development decision for two years. Many contracts were reduced, delayed, or canceled resulting in scaled-back demonstration and validation activities that, according to SDIO, will not provide enough information to support an informed 1993 deployment decision. For example, the identification of system-level demonstration and validation requirements in support of system-level tests will not be established until fiscal year 1992; and by 1993, testing on command and control functions will not be as thorough as originally planned. Further, because the new Phase I architecture will not be defined until 1991, the elements will be less developed and their designs less detailed to support system-level testing. Finally, the system's communications network will not be tested for real time oper-

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[36] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[37] Letter and fact sheet prepared by Director SDIO in response to request by Senator Pete Wilson regarding the effects of funding cuts on the SDI program, July 7, 1989.

ations. All this means that a 1993 decision to deploy would be based on incomplete information and uncertainties.[38]

The administration's amended fiscal year 1991 budget request was $4.46 billion. The Congress reduced SDIO's request by over 30 percent to $2.9 billion. It is not clear at this time whether the aforementioned 70 percent funding level impact statements made by the Director are still valid.

## VIII. Funding Requirements Keep Changing; Phase I Costs Uncertain

Through the end of fiscal year 1990, the Congress will have appropriated nearly $20 billion for the Strategic Defense Initiative since it was formally established in 1984. Of the $20 billion appropriated for the SDI to date, less than $2 billion has been spent on Phase I research. Since 1987, cost estimates for the development and deployment of Phase I have been decreasing.

### A. DECLINING COST ESTIMATES FOR PHASE I SYSTEM ARE QUESTIONABLE

As mentioned earlier, in June 1987, SDIO cost estimates for Phase I development and deployment ranged between $94.2 billion and $183.6 billion (in then-year dollars). In October 1988 SDIO reduced its estimate to $87 billion (in then-year dollars).[39] According to SDIO officials, the incorporation of Brilliant Pebbles into the architecture will cut costs by 20 percent, that is, from $87 billion to $69 billion (both figures in then-year dollars). As only $2 billion has been spent on Phase I to date, most of the $69 billion is yet to be spent.[40]

SDIO's $69 billion estimate for Phase I represents only a "snapshot at a point in time" as the system is still changing. However, Department of Defense experience has shown that such early estimates usually increase significantly for a variety of reasons.[41]

### B. CREDIBILITY OF COST ESTIMATES

As mentioned earlier, the SDIO cost estimate for Phase I dropped from $183.6 billion in then-year dollars in June 1987, to $142.9 billion in June 1988 to $89 billion in October 1988. At the request of Chairman Conyers, the GAO examined the reasons for the cost reductions between June 1987 and October 1988. In the March 1989 hearing on the SDI cost estimates, Chairman Conyers stated:

> This dramatic reduction in the estimate for Phase I of the Strategic Defense Initiative has raised questions about

[38] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[39] Fact sheet for the chairman, Legislation and National Security, Subcommittee, Committee on Government Operations, House of Representatives, "Strategic Defense Initiative: Funding Needs Through Completion of Phase I System," (GAO/NSIAD-90-79FS).

[40] The $69 billion does not include the costs for operating and maintaining the system. During the period of full-scale development and deployment of a Phase I system, the SDIO will require *additional* funds for researching and exploring more exotic technologies and systems for follow-on phases.

[41] Unclassified summary to the chairman, Legislation and National Security Subcommittee, Committee on Government Operations, House of Representatives, "Strategic Defense Initiative Program: Basis for Reductions in Estimated Cost of Phase I," GAO/NSIAD-90-173.

what the Phase I estimate includes, and more importantly, what it doesn't cover.[42]

GAO based its conclusions on cost models of four elements and determined that the October 1988 cost estimate was appropriately prepared, but SDIO had made some errors that understated the cost by $2.1 billion. SDIO may also have used overly optimistic assumptions in preparing one of the element estimates, which caused it to be understated by at least $5 billion.[43]

GAO went on to say:

> Even though SDIO applied proper cost estimating methods, the credibility of the estimate largely depends on the validity of assumptions used in the estimate. GAO and the Department of Defense's Cost Analysis Improvement Group believe that some of the assumptions used by SDIO may be too optimistic.[44]

During the March 1989 hearing, Chairman Conyers expressed concern over some of SDIO's assumptions. He stated:

> So, it's one thing to cut costs. It's another thing to predict cost reductions when you are assuming that the technology required to build a system will be available.
>
> There seems to be a lot of "iffiness", which, if my suspicions are correct, is going to really—in several years—start raising this cost back up again."[45]

In response to questions by the chairman on SDIO's assumptions, Mr. Frank Conahan, Assistant Comptroller General for GAO's National Security and International Affairs Division testified that:

> SDIO, for example, assumes that the technology required will be available when needed, that the contractors will be successful in developing and implementing innovative production processes and techniques to significantly reduce the cost of the system, and that the program can stay on a relatively tight schedule. Some of the technology that will be needed to build the Phase I system is not yet available. Also, the size and quantities of some of the components needed for the system will require innovative production processes and techniques to achieve the current cost estimate. If any of these slip, adjustments will have to be made because the schedule is very tight, and there is really not much time in there for SDIO to regroup and make these kinds of adjustments. The independent cost analysts within DOD had similar observations.[46]

By incorporating Brilliant Pebbles and eliminating the Space-Based Interceptor, SDIO claims that the $89 billion cost estimate could be reduced to $69 billion (in then-year dollars). Brilliant Peb-

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[42] Hearing on "Cost Estimates for Phase I of the Strategic Defense Initiative" before the Legislation and National Security Subcommittee, House Committee on Government Operations, 101st Congress, March 21, 1989.
[43] Ibid.
[44] Ibid.
[45] Ibid.
[46] Ibid.

bles cost estimates remain very uncertain. Consequently, it is not possible to accurately estimate costs of deploying a technology for which important technical problems remain to be solved. An Air Force cost estimate of the Lawrence Livermore National Laboratory Brilliant Pebbles concept dated October 31, 1989, estimated that the development and production of Brilliant Pebbles to full operation capability would be nearly $12 billion (in 1988 dollars). However, critical to the cost of a Brilliant Pebbles system is the final weight and price of each Pebble and how 4,000 plus platforms will be deployed, maintained, command and controlled, and replaced.[47]

According to a September 1989 CRS report, individual Pebble cost estimates have ranged between $100,000 to over $1 million apiece. Unit price greatly depends on whether or not the Pebbles can be mass produced. Also, deployment costs can vary significantly depending on the type of launch vehicle.[48] However, as Brilliant Pebbles is only in the concept definition stage of system development, its hardware and system configuration remains uncertain, and SDIO's ongoing assessments may substantially change their configuration and, therefore, their cost. Furthermore, potential changes in the architecture, such as removing the Boost Surveillance and Tracking System from the Phase I architecture (which according to SDIO would reduce the cost estimate to about $56 billion in then-year dollars) and reducing tracking requirements for the Space Surveillance and Tracking System may increase the requirements imposed on Brilliant Pebbles and possibly, its associated costs.

## IX. Brilliant Pebbles May or May not be Cost Effective

A number of studies have been conducted on the cost effectiveness of Brilliant Pebbles. As mentioned earlier, Public Law 99-145 requires that the President must certify to the Congress that the Strategic Defense System is survivable and that it meets the Nitze criteria of being cost effective at the margin before any part of the system can be deployed. For a weapons system to be cost effective at the margin means that the cost of producing and deploying the weapon is significantly less than the cost to defeat it by an enemy. There are various opinions on the cost effectiveness of Brilliant Pebbles. An unclassified report recently released by Lawrence Livermore National Laboratory concluded that it is highly unlikely that Brilliant Pebbles will be cost effective. According to the report, each Pebble would cost about $2 million to produce and deploy—this is almost double earlier estimates; however, each nonnuclear antisatellite weapon designed to target a Pebble could probably cost less than $500,000.[49] However, other reports have indicated that this is not the case and that Brilliant Pebbles is highly cost effective. However, until the design and requirements for Bril-

[47] Computer Professionals for Social Responsibility, Inc., "The Brilliant Pebbles Proposal," June 1989.

[48] Congressional Research Service report for Congress, "Brilliant Pebbles: Implications for the Strategic Defense Initiative," September 28, 1989.

[49] "ASATS vs. Brilliant Pebbles," Roger D. Speed, Lawrence Livermore National Laboratory, March 1990, UCEL-ID-103669.

liant Pebbles are finalized, it is not clear how a valid determination can be made as to Brilliant Pebbles costs or cost effectiveness.

## X. Defense Oversight of SDI Program Is Questionable

From the time that Phase I of the Strategic Defense System entered Defense's major acquisition process, senior officials have been struggling with how to oversee and manage such a system. According to a GAO report, the complexity, cost, and uniqueness of the Strategic Defense System prompted the need for a more stringent acquisition process. The DAB was to conduct yearly reviews of the program to ensure program goals are being met with respect to cost, schedule, technical performance, and operational assessments.[50]

### A. 1989 DAB Review Did Not Occur

Major changes to Phase I occurred without high-level Defense oversight and management review. For example, although the space-based architecture study and the Defense Science Board study recommended that research continue on both the Space-Based Interceptor and Brilliant Pebbles, SDIO decided to include Brilliant Pebbles in the Phase I architecture. This fundamental change to the program baseline was made without formal DAB review and oversight.

Additionally, reductions in test and evaluation requirements for development and deployment decisions were made without DAB review. The GAO found that SDIO will not conduct integrated system-level tests in real time incorporating actual hardware and software prototypes with human intervention prior to the presidential decision on deployment.

> Since these significant reductions in demonstration and validation requirements have not been subject to DAB review, high-level Defense Officials have not passed judgment on whether sufficient information will now be available to make an informed deployment decision.[51]

### B. Oversight of Brilliant Pebbles Unknown

Because of Presidential guidance, SDIO has expedited the research and development of Brilliant Pebbles. Consequently, Brilliant Pebbles has been placed in an accelerated acquisition program. As mentioned earlier, from concept definition, Brilliant Pebbles will move into "pre-full-scale development" which roughly translates to Defense's concept demonstration and validation stage. Brilliant Pebbles has not, to date, been subject to a DAB milestone review. At this point, it is not clear what, if any, oversight is occurring.

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[50] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

[51] Ibid.

### C. JUNE 1990 DAB REVIEW "PURELY INFORMATIONAL"

According to an acquisition decision memorandum dated June 19, 1990, the Defense Acquisition Board (DAB) did review the Strategic Defense Initiative Program on June 15, 1990. According to a Defense official, the DAB was purely informational. The Director, SDIO, presented a review of the Brilliant Pebbles program in the context of the overall SDI program. Although the Under Secretary of Defense for Acquisition recommended milestone I approval for another element in the architecture—the ground-based radar—no such decision was made on Brilliant Pebbles. The Under Secretary simply approved proceeding with Brilliant Pebbles as briefed to the DAB. SDIO will not have to present a system-level baseline for Phase I or a system and element level cost estimate for Phase I until the spring of 1991.[52]

### D. DEFENSE REASSESSING SDI ACQUISITION PROCESS

GAO officials have reported that one of the reasons why the 1989 DAB did not occur was because of a desire by the Under Secretary of Defense for Acquisition to examine the appropriateness of the acquisition process for a system such as the Strategic Defense System.[53] According to the acquisition decision memorandum mentioned above, the Under Secretary has directed the Chairman of the Strategic Systems Committee to initiate a task force that will make recommendations regarding the role of the DAB in the SDI over-sight process. These recommendations are to include, among other things, how acquisition phases such as demonstration and validation will apply to the Strategic Defense System as an overall system.[54]

## XI. RECENT CONGRESSIONAL ACTION ACKNOWLEDGES GAO CONCERNS WITH SDI

The July 1990 GAO report recommended to the Congress that:

> The Congress not fund full-scale development for any element of Phase I until SDIO has stabilized the architecture and has demonstrated the effectiveness of the system through integrated system-level tests in real time, using system hardware and software prototypes with human intervention. This would include not providing $265 million for the Boost Surveillance and Tracking System in fiscal year 1991. However, if Defense needs the Boost Surveillance and Tracking System for another mission, independent and separate from the Strategic Defense System, it should be justified and funded to meet that mission and should no longer be considered an element of the Strategic Defense System.[55]

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[52] Acquisition decision memorandum for Strategic Defense Initiative Program, June 19, 1990.
[53] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).
[54] Acquisition decision memorandum for Strategic Defense Initiative Program, June 19, 1990.
[55] Report to the chairman, Subcommittee on Legislation and National Security, House Committee on Government Operations, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy," dated July 6, 1990 (GAO/IMTEC-90-61).

The administration's amended budget request for SDI Defense activities for fiscal year 1991 was $4.46 billion. The Senate Armed Services Committee decided to provide $3.573 billion for SDI activities. The report from the committee stated:

> The committee is increasingly concerned that the SDIO's continuing focus on Phase I research, driven by a deadline calling for an "informed decision" in the summer of 1993, is leading to an unbalanced program.[56]
>
> The committee wishes to make clear that it does not endorse an arbitrary deadline for an "informed decision", and affirms its guidance to the Department of Defense that, in the current environment, there is no need to incur the higher risks, and often higher costs, of highly concurrent "crash" programs, (e.g. the accelerated acquisition program for Brilliant Pebbles) whether in the various phases of development or overlapping development and production.[57]

The committee also denied full-scale development funding for fiscal year 1991 for the Boost Surveillance and Tracking System. The committee stated that if SDIO no longer requires the system, it is inappropriate for SDIO to continue funding the program and the Air Force should assume this responsibility.[58]

In a similar action, the House Armed Services Committee cut the $4.46 billion request to $2.9 billion. The committee went on to say:

> The Administration requested $265 million for full-scale development of the Boost Surveillance and Tracking System (BSTS). If approved, BSTS would have been the first SDI program element to reach full scale development. The committee denied the requested funds for full-scale development in fiscal year 1991 . . . Noting that BSTS is not required in the current SDI Phase I, the committee also instructed the Secretary of Defense to transfer BSTS to the Air Force . . .[59]

In a Senate bill, cited as the "National Defense Authorization Act for Fiscal Year 1991," the Senate makes the following findings:

> (1) The Strategic Defense Initiative (SDI) has become too focused on a projected 1993 presidential decision on whether the United States will deploy a space-based kinetic energy weapon system, known as "Brilliant Pebbles."
>
> (2) There has been tremendous instability in the Phase I architecture of the Strategic Defense System.
>
> (3) A decision to deploy the phase I architecture of that system would have grave implications for offensive arms reduction negotiations with the Soviet Union and for con-

[56] "National Defense Authorization Act for Fiscal Year 1991: Report on Authorizing Appropriations for Fiscal Year 1991 for Military Activities of the Department of Defense" Committee on Armed Services, U.S. Senate Report 101-384, 101st Congress, 2d Session.
[57] Ibid.
[58] Ibid.
[59] "FY91 Defense Authorization Bill Committee Markup" Summary of Major Actions, July 31, 1990, House Armed Services Committee, House of Representatives, 101st Congress, 2d Session.

tinued United States compliance with the 1972 Anti-Ballistic Missile Treaty.[60]

The bill went on to direct that the SDIO should—in the near-term—research a defense system that would be treaty compliant and protect against an accidental missile launch against the United States or a limited ballistic missile attack against the United States by a third world country. Additionally, the bill put limitations for spending on Phase I activities. SDIO had asked for $329 million for Brilliant Pebbles, but the bill stated that not more than $129 million may be obligated for the Brilliant Pebbles program. Finally, the bill directed that the Secretary of Defense submit a report on the allocation of funds appropriated for SDI for fiscal year 1991 and specify the amount for each program, project, and activity of the Strategic Defense Initiative. The report must be submitted within 90 days after the date of the enactment of legislation appropriating funds for SDI for fiscal year 1991.[61]

Closely following the Senate's bill is the House's Defense authorization bill for fiscal year 1991 which also makes significant changes in the strategic defense arena and voted to cut SDI's budget to $2.3 billion.[62] The House and Senate conferees reconciled to $2.9 billion.

## XII. Conclusions

The Strategic Defense Initiative Organization is engaged in one of the most complex, technologically challenging, controversial, and costly efforts ever undertaken. Tens of billions of dollars will be needed to develop and deploy just the first phase of the Strategic Defense System. Members of this committee have expressed concern over the uncertainties surrounding the final cost of this program. The program had been structured to permit a presidential deployment decision by 1993; however, Public Law 99-145 requires the President to certify to the Congress that Phase I can effectively fulfill its mission and that it is cost effective. Because the program is still changing, the criteria set forth in Public Law 99-145 cannot be met in time to support an "informed decision" by the 1993 decision date. A fundamental question to be addressed is whether SDIO's current threat—which is driving the program—is still an appropriate one. If it is not, Congress and the administration must consider whether another type of threat justifies the continuation of the SDI program in its present form. Additionally, many questions surround such critical issues as system objectives, architecture, system-level testing, funding, cost, cost effectiveness, and oversight.

The concept of the Strategic Defense Initiative or "Star Wars" emerged in 1983. At that time, the United States was facing an unambiguous military threat from the Soviet Union's massive war machine. This threat included thousands of intercontinental ballistic missiles pointed at the United States. The initial primary objective of the Strategic Defense System was to protect the United

[60] "National Defense Authorization Act for Fiscal Year 1991," bill S. 2884, August 4, 1990, U.S. Senate, 101st Congress, 2d Session.
[61] Ibid.
[62] Congressional Record, September 18, 1990, proceedings and debates of the 101st Congress, 2d Session.

States from a massive ballistic missile attack by the Soviet Union. With the decision to proceed with a phased acquisition and deployment, however, SDIO changed its near-term objective to deterrence—to provide such a formidable defense that the enemy would not benefit from launching a massive ballistic missile attack. If such a launch occurred, however, the system would intercept and destroy missiles and warheads as they travel toward the United States. Phase I was to destroy a certain classified percentage of the Soviet missiles and warheads, thus creating uncertainty as to whether the Soviets could achieve their war aims. It would take follow-on phases and technologies to provide the "total" defense initially envisioned. As the cold war thawed, even though the Soviet capability to attack had not changed, it became fairly obvious that an accidental launch or a limited attack from some other nation might be more likely than a massive ballistic missile attack from a country that is in economic and political shambles. Still, Defense continued with the Phase I objective of deterrence but added the caveat that Phase I might also protect against an accidental launch or limited attack. However, a system for deterrence such as Phase I—which is supposed to form the framework for follow-on phases and "total defense"—may or may not be fundamentally different from the kind of system needed to provide limited protection. After all, the mission requirements should drive the system design.

Despite several years in Defense's formal acquisition process, the Phase I architecture remains in a state of flux. As the GAO report stated, the addition of Brilliant Pebbles significantly altered the architecture and caused a major restructuring of the SDI program. The architecture has changed significantly with respect to numbers and types of elements. Brilliant Pebbles is now the "cornerstone" for Phase I even though two Defense studies recommended continued research before its adoption. The two space-based sensors may no longer be elements of Phase I, and SDIO is counting on Brilliant Pebbles—which is still in concept definition—to provide those capabilities. This raises questions as to whether Brilliant Pebbles will be able to provide the infrastructure to support follow-on phases.

Meanwhile, SDIO is undertaking another major restructuring. The new SDIO Director has stated that there will likely be a change in focus of near-term deployment efforts from deterrence to a Global Protection Against Limited Strike (GPALS) System. The Director went on to say that GPALS has gained interest because of the third world ballistic missile threat. As a result, SDIO will probably be migrating to different system objectives in the near future. According to the Director, the GPALS will not take the place of the current Phase I, but could grow to a Phase I Strategic Defense System. However, if GPALS includes Brilliant Pebbles, it is not clear that GPALS would be the most cost effective system for short or intermediate range ballistic missiles without significant design changes in Brilliant Pebbles. Additionally, it is also not clear to this committee how a GPALS will cost effectively grow into Phase I when the mission and system objective—which drive the design of the system—are different. A new Phase I will be presented to the Defense Acquisition Board in the spring of 1991. What the new

Phase I system objectives and resulting design will be is anybody's guess.

On July 25, 1990, Comptroller General Bowsher appeared before the House Committee on Armed Services. One of his main areas of concern was on Defense's lack of adequate testing of weapon systems. He stated that:

> DOD needs to more fully test the weapon systems it is developing and correct identified problems to assure itself that these systems perform as required before they are procured. During the past 10 years, billions of dollars were wasted on systems because this was not done. The reason usually given for following this practice was that systems were needed quickly to meet the Soviet threat.[63]

We agree with General Bowsher's assessment. Therefore, the urgency to produce systems to meet the Soviet threat is no longer so great. As such, Defense should devote more time to ensure adequate system testing occurs.

The fallacy of sacrificing adequate testing for early deployment is highlighted by the Hubble Space Telescope. It is well documented that the Hubble was not adequately tested before it was launched into orbit. Consequently, it does not work effectively and fixing it in space will now be more costly and cannot be accomplished for several years. This is but a small example of the problems that could beset a far more complex Phase I system composed of thousands of space-based components.

It is not clear to this committee how SDIO can develop test plans without a stable design. The incorporation of Brilliant Pebbles has forced a restructuring of the program and a reassessment of test plans. SDIO test and evaluation officials had to immediately begin inculcating Brilliant Pebbles. Many tests, based on the earlier Phase I design, will no longer be valid and will have to be repeated. Furthermore, since Phase I may yet change again and consequently Brilliant Pebbles may not be the "cornerstone," detailed system-level test plans cannot be developed at this time. Even before the incorporation of Brilliant Pebbles, SDIO had significantly reduced its test requirements for making deployment and development decisions. Even though Defense's own studies cited the importance of real-time, system-level tests incorporating hardware and software prototypes with human intervention, no such tests will be conducted prior to 1993. According to SDIO, minimum funding levels are needed for an informed decision by 1993 on deployment. Fiscal year 1990 funding requests were cut 20 percent; it appears that fiscal year 1991 funding requests will be cut by 30 percent. Whether the impact statements made by the Director of SDIO to Senator Wilson in July 1989 are still valid is not clear.

Cost estimates for the Phase I system have also been in a state of flux. The huge range of estimates from $183.6 billion in 1987 down to the most "current" cost of $57 billion [64] (both in then-year dol-

[63] Testimony on "Department of Defense: Improving Management to Meet the Challenges of the 1990's." Statement of Charles A. Bowsher, Comptroller General of the United States before the Committee on Armed Services, U.S. House of Representatives, 101st Congress, 2d Session, July 25, 1990 (GAO/T-NSIAD-90-57).

[64] This would be Phase I with Brilliant Pebbles, no Boost Surveillance and Tracking System, and reduced functionality of the Space Surveillance and Tracking System.

lars) causes concern. It may be that SDIO is adjusting its estimate to match current levels of support. The GAO had previously expressed concern with some of the assumptions used in costing the system and found that some of the costs had been understated. While the cost for Brilliant Pebbles has been purported to be about $12 billion, it is not clear what costs have or have not been included in this estimate. For example, if SDIO keeps increasing the requirements for Brilliant Pebbles, its weight and cost may go up accordingly. As mentioned above, neither this committee nor SDIO knows at this time what Phase I is, so its associated cost estimate is also elusive.

A fundamental standard for weapon systems by defense experts, espoused by Paul Nitze and adopted by the Congress, is cost effectiveness. The Congress enacted the Public Law 99-145 to ensure the Nitze criteria was adhered to. The recent study released by Lawrence Livermore National Laboratory on the cost effectiveness of Brilliant Pebbles now creates more concern over the premature incorporation of the weapon into the Phase I architecture. Although other reports state that Brilliant Pebbles is cost effective, it is not clear how this issue can be resolved until Brilliant Pebbles design and requirements are finalized.

Equally uncertain and troubling to this committee is the amount and quality of high-level oversight of the SDI program. The July GAO report concluded that such oversight was not occurring. Major decisions to change the design, reduce test requirements, and to enter Brilliant Pebbles into an accelerated acquisition program were made without formal review. The Under Secretary of Defense for Acquisition is currently trying to grapple with what role the Defense Acquisition Board should even play in SDI. However, it is clear that high-level Defense oversight is not occurring. Without such oversight, the risk of ill-advised, high-risk decisions such as incorporating Brilliant Pebbles, without considering system design, testing, and integration consequences, increases.

Notwithstanding the Soviet Union's arsenal of intercontinental ballistic missiles, the geopolitical reality is that the most immediate threat facing the United States is not from the Soviet Union. History was made on September 9, 1990, at Helsinki with a common accord from Presidents Bush and Gorbachev to stand together against Saddam Hussein. Surely our more urgent near-term threat is a megalomaniac who may one day be armed with a range of nuclear, chemical, and biological weapons, rather than a Soviet Union in the process of fundamental economic restructuring and which has become allied with us in major diplomatic initiatives. Furthermore, the United States and Soviet Union are attempting to finalize a Strategic Arms Reduction (START) agreement by the end of this year. In conclusion, this committee believes that many questions need to be answered before continuing to actively explore the option of putting weapons in space, abrogating the ABM Treaty, and committing billions of dollars to a system that may not be justified.

### A. FINDINGS

1. SDIO has structured its program to support a Phase I deployment decision by the President by 1993; however, the criteria set forth in Public Law 99-145 will not be met by that time.

2. SDIO has changed its approach to strategic defense by incorporating Brilliant Pebbles into the Phase I architecture. Phase I of the Strategic Defense System is still changing.

3. Because of Brilliant Pebbles, some previous tests and analyses are moot; many tests will have to be repeated; and, because the architecture continues to change, detailed test plans cannot be developed until the design is stabilized.

4. Even prior to the insertion of Brilliant Pebbles, SDIO had reduced its test and evaluation requirements for deployment and development decisions. SDIO does not intend to conduct real time integrated system-level tests prior to 1993.

5. SDIO officials believe that they will be able to support an informed decision by the President by 1993, but that it will be made with increased risk.

6. The 1972 ABM Treaty, under the current interpretation, precludes many of the kinds of detailed tests needed to support an informed decision.

7. The cost estimate for Phase I is also in a state of flux. It is impossible to estimate the costs involved if SDIO has not defined its system.

8. According to recent studies, Brilliant Pebbles may or may not be cost effective; however until Brilliant Pebbles' design and requirements are finalized it is difficult to determine system cost effectiveness.

9. High-level Defense oversight, commensurate with such a complex and costly program as SDI, is not occurring.

### B. RECOMMENDATIONS

*The Committee Recommends That the Secretary of Defense*

1. Direct a comprehensive reexamination of Defense's strategic defense goals, generally, and SDI specifically, including both near- and long-term program objectives.

2. If strategic defenses are deemed to be warranted, identify Phase I system objectives, detailed system requirements, system costs, and realistic timeframes. Ensure that the design is stabilized and integrated system-level testing is performed prior to recommending any part of the system for full-scale development or deployment.

3. Specifically, structure the program to ensure that:

—An appropriate mix of near-term Phase I efforts and research for long-term payoffs occur.

—Near-term program objectives are Treaty compliant and can therefore involve sufficient testing without risking Treaty violation.

4. Require SDIO to provide evidence that Brilliant Pebbles is cost effective at the margin.

5. Require SDIO to provide evidence that GPALS or any other proposed limited protection system can engage short and interme-

diate ballistic missiles and that such a system can effectively grow into Phase I—if Phase I is deemed warranted.

6. Require the Defense Acquisition Board to provide oversight commensurate with such a costly and complex program and make available to the Congress the Cost Analysis Improvement Group's study on the cost estimate for SDI with Brilliant Pebbles included in the Phase I architecture.

## ADDITIONAL VIEWS OF HON. TED WEISS, HON. CARDISS COLLINS, HON. HENRY A. WAXMAN, HON. MIKE SYNAR, HON. BARNEY FRANK, HON. BARBARA BOXER, HON. MAJOR R. OWENS, HON. EDOLPHUS TOWNS, HON. NANCY PELOSI, HON. DONALD M. PAYNE, AND HON. DENNIS E. ECKART

This report is an example of the best work product of the committee, and we want to commend the full committee chairman for the excellent oversight work that his subcommittee has conducted on the Strategic Defense Initiative. The report raises some very serious questions about SDI's costs and effectiveness, and we support its approval.

But not only is SDI not cost or strategically effective, it will escalate the world arms race and cause the United States to violate the ABM treaty, ratified in 1972.

In the many years that we have been debating SDI, successive administrations have repeatedly assured the Congress that SDI is merely a program of research which is not affected by the ABM treaty. However, the facts, and the thrust of this report, speak otherwise.

We do have concerns that the findings and recommendations of the report might be misconstrued as the committee taking a position in favor of the continuation of the SDI program, or that the program could be redesigned to be more cost-effective or treaty-compliant. The path toward eventual deployment of SDI, still pursued by the current administration in this day of de-escalating world tensions, and overwhelming budget deficits, is a path with which we do not want to be associated.

The Nation could ill-afford the folly of Reagan's star wars dream a decade ago. Twenty billion dollars later, we can barely afford even the more prudent course of continuing with its basic research.

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CARDISS COLLINS.
HENRY A. WAXMAN.
MIKE SYNAR.
BARNEY FRANK.
BARBARA BOXER.
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## DISSENTING VIEWS OF HON. JON L. KYL, HON. WILLIAM F. CLINGER, JR., HON. AL McCANDLESS, HON. HOWARD C. NIELSON, HON. RICHARD K. ARMEY, HON. J. DENNIS HASTERT, HON. STEVEN SCHIFF, HON. CHUCK DOUGLAS, AND HON. C. CHRISTOPHER COX

It is unclear why the Committee on Government Operations prepared this report on SDI. If, as its title implies, it was to make the point that SDIO's ability to provide sufficient information to support a 1993 "decision on deployment" is in doubt, this could have been said in one page with unanimous agreement. Because of congressional underfunding of the program, a 1993 decision is no longer likely. To the extent the report infers that this is because of some problem with the SDI program, as opposed to congressional underfunding, the report is misleading.

Regrettably, in all of its 70 pages, this report contributes nothing new to the debate on SDI; in fact, the report is essentially a reiteration of a July 1990 GAO report on the SDI program, titled, "Strategic Defense System: Stable Design and Adequate Testing Must Precede Decision to Deploy."

Moreover, as originally written, this report was obviously biased against SDI; though revisions have removed much of the negative tone.

Balance is still lacking, however. Nowhere is there any acknowledgement of the significant progress achieved in the program; progress in meeting the technical challenges associated with strategic defenses, including demonstrating the capability to detect, track, acquire and intercept missiles and re-entry vehicles in all phases of flight; progress in miniaturization which is key to meeting cost, weight and survivability goals; progress in computer technology which, for example, offer the possibility of producing high-speed computers in small packages—about the size of a deck of cards with the processing speed and data throughput of a Cray-1 computer. The report also ignores SDI's technology spin-offs in the areas of medicine, electronics, optics and manufacturing techniques, just to name a few.

What is most troubling, however, is what appears to be an underlying assumption that the likely inability of SDIO to support a 1993 deployment decision is the result of the way SDIO is conducting the program. This is unfortunate, and untrue.

The extent to which a 1993 decision on deployment will not be supportable is almost exclusively the result of reductions in funding by the U.S. Congress. These significant funding reductions have had an indisputable negative impact on meeting program goals. Since FY 1985, funding for SDI has been reduced 25 percent from requested levels. The FY 1991 defense authorization bill cuts over one-third from the President's request for SDI. The results of this history of funding reductions include schedule slippages, cancella-

tion of contracts, increased program costs, premature down selects between competing technologies and system designs, and increased technical risk. This is not to mention the loss of scientists and engineers in the program.

In addition, the SDI program is evolving rapidly because of remarkable technological progress. What are rather negatively portrayed in this report as major restructurings in the program architecture are, in fact, modifications of system elements and designs which result in increased capabilities at reduced costs. It does not lend credibility to this report to infer that technological progress and innovation in complex technology programs is a problem.

In response to the July 1990 GAO report, which is quoted heavily in this report, SDIO prepared a point paper taking issue with that report. We excerpt here sections of that point paper as it relates to issues raised in this report:

> Deployment decision: GAO mistakenly equates a Presidential decision that will be based on broad matters of national security, global stability, and the spread of ballistic missiles and nuclear technology with Secretary of Defense acquisition process milestone decisions. Given a proper level of funding, SDIO will be in a position to responsibly advise the President that the Nation's investment in SDI research and development had produced the technology that can be systematically developed and applied to deter and eventually defeat a ballistic missile attack. The development of a strategic defense system will follow the President's decision and will meet all the criteria of DoD's weapon system acquisition process.
>
> The Presidential decision on deployment will be a decision to proceed with the program and make the investment required for full scale development. It will not be a decision to build and put in a position a strategic defense system. This is referred to as a "decision on deployment" because the full scale development decision which will follow is not taken lightly and will be made only if there is serious intent to deploy the system.
>
> The Presidential decision will be a strategic decision on the future of the program. At that point, there still will be much development and testing to be done. There will also remain a final decision to produce and deploy the system to be made at the conclusion of a successful development effort and testing program. Specific acquisition decisions on the detail of the system design and program structure will be made within the context of the acquisition process. To suggest that the Presidential decision in 1993 will be premature because the system design and testing will not be complete is to misunderstand the nature of that decision.
>
> The President's options will go beyond simply deploying, delaying, or cancelling Phase I. The President will also have options on the content and structure of the system to be developed. It is wrong to equate having options with instability or lack of definition in the program.

System stability: GAO confuses system architecture with system design. Phase I of the strategic defense system consists of space-based and ground-based layers capable of detecting, tracking, intercepting nuclear-tipped ballistic missiles in the boost, postboost, and midcourse stages of flight. Each layer consists of sensors and interceptors based on kinetic energy physical principles. Brilliant Pebbles combines the functions of detection, tracking, and interception in a single element of the space-based layer. GAO grossly exaggerates the program adjustments that follow introduction of Brilliant Pebbles at the architecture level. This changed the design of the elements, not the Phase I architecture, and does not negate previous analysis and test data.

It was that very test data and analysis which led to the replacement of the Space-Based Interceptor with Brilliant Pebbles. Further, the introduction of Brilliant Pebbles has reduced the complexity of the Phase I architecture, eliminated the dependence of the space-based weapons on BSTS, and reduced the difficulty of integration, essentially simplifying and stabilizing the architecture. To suggest the previous testing and analysis was wasted because it motivated a change in the system is to misunderstand what a test and evaluation program is all about.

System testing: GAO misrepresents this program by stating that plans for a more ambitious test program were changed or abandoned for a less sophisticated approach. This is incorrect. SDIO has a aggressive simulation and test program. The SDIO simulation and test program for Phase I has proceeded along the original STELLAR Task Force Plan. The first phase is oriented to sector or subsystem testbeds, all feeding a non-real time system simulator.

SDIO recognizes the desirability of "integrated, real time system-level testing with prototype system hardware and software," but the Congress insists such testing not be done, under the narrow interpretation of the ABM Treaty. Furthermore, live system test to counter reentry vehicles and penetration aids is not necessary to validate the architectural concept, as is the purpose of the concept demonstration and validation phase.

Although SDIO would prefer higher fidelity and less complicated testing than permitted by the narrow interpretation of the ABM Treaty, SDIO rejects the GAO conclusion that a Presidential decision cannot be made without "integrated, realtime, system-level testing with system hardware and software." We continue to study testing options, considering live and simulated tests, but at this moment we believe that Presidential and development decisions must depend on simulated subsystem and functional testbeds capped with a non-real time system simulator. This approach is feasible and attainable, and our studies indicated that it *can* provide all the necessary information for informed decisions.

DOD oversight: The DoD weapon system acquisition process is based on high level, event driven management decisions and program manager level execution responsibilities. DoD decisions are set at defined milestones: concept definition, demonstration/validation, full scale development, and production/deployment. Because the strategic defense system is comprised of elements individually executed by SDIO, the Air Force, and the Army, DoD supplements element level decision events with periodic in-process program reviews at the system-level.

GAO generated a strawman to form its lack of DoD oversight argument. Specifically, GAO erroneously equates in-process reviews with decision events. That is a fundamental misstatement of the purpose of the in-process periodic reviews. Moreover, there was considerable DoD oversight during the period, and, in December 1989, the Strategic Systems Committee which advises the Defense Acquisition Board conducted a thorough, detailed review of SDIO'S planned insertion of Brilliant Pebbles into the space-based layer of the Phase I architecture.

There is much to discuss about SDI. It is not at all clear that this report contributes meaningfully to that discussion.

For the above stated reasons, we cannot support this report.

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AL MCCANDLESS.
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# APPENDIXES

## APPENDIX I

### DEPARTMENT OF DEFENSE—MAJOR SYSTEMS ACQUISITION STAGES

Mission area analysis and program initiation generally precede the five Department of Defense acquisition stages. Defense components continually analyze their assigned mission areas to identify deficiencies (needs) and determine if new systems or major upgrades to existing systems are necessary. These analyses often result in recommendations to initiate new acquisition programs through the validation of a need to correct the deficiency. Once a need has been identified and validated and Defense initiates an acquisition program, the program enters the concept formulation stage.

*Concept formulation stage*

In this stage, potential requirements and alternative approaches to satisfy the need are identified and evaluated. Various types of analyses considering trade-offs among performance, life-cycle cost, and schedule are conducted to select among possible concepts to satisfy the need. Once a concept has been selected, it is presented to Defense for approval.

*Demonstration and validation stage*

In this stage, feasibility and desirability of the selected requirements and the system concept are further analyzed, generally using techniques like computer simulation, hardware prototyping, development test and evaluation, operational test and evaluation, or a combination of test methods. When the feasibility of the concept has been convincingly demonstrated and validated, the program enters the full-scale engineering and development stage.

*Full-scale development stage*

In this stage, the system, including every item necessary for its logistic and operational support, is designed, fabricated and tested. At the conclusion of this stage, the system is ready to be produced.

*Full-rate production and initial deployment stage*

During this stage the proposed system is built and released to the user. At this point, the system becomes operational.

*Operations support stage*

This stage immediately follows deployment and extends until the system is removed from Defense inventory. Two major Defense reviews are conducted in this stage. The first takes place 1 to 2 years

after deployment to determine if operational readiness and support objectives are being achieved and maintained. The second occurring 5 to 10 years after deployment, evaluates system capabilities and assesses whether major upgrades are needed or if the system should be replaced.

## APPENDIX II

### STRATEGIC DEFENSE SYSTEM—ELEMENTS OF PHASE I

| System Element | General function | Specific functions |
|---|---|---|
| Boost Surveillance and Tracking System. | Sensor | Detect missile launches; acquire and track boosters; assess kills. |
| Space Surveillance and Tracking System. | Sensor | Acquire and track warheads and satellites; assess kills. |
| Ground Surveillance and Tracking System. | Sensor | Track warheads and decoys; discriminate warheads from decoys; assess kills. |
| Ground-Based Radar | Sensor | Acquire and track warheads and decoys; discriminate warheads from decoys. |
| Space-Base Interceptor | Weapon | Destroy boosters and warheads. |
| Ground-Based Interceptor | Weapon | Destroy warheads. |
| Command Center | | Human decision making; communications and guidance for defense system. |